

ENMA 463
Macroprocessing of Materials in Electronic Packaging
Fall 2007
Professor A. Christou

The objectives for this course is to attain an understanding of the science and technology for processing (fabricating) materials whose key dimensional feature size is above the micron scale and either approaches tens of microns and above. The course will feature electronic packaging technologies as a demonstration vehicle for macroprocessing. The processes will be based on solidification, and crystal growth, solder and interface control, cold working and hot working and deformation processing, oxidation and corrosion. The students through a series of problem solving and two projects will come to understand crystal growth and semiconductor wafer preparation, thick film interconnect science and technology in electronic packaging. The students will also address the science and technology issues for processing of metals and alloys. The topics to be covered include deformation processing of metals, strengthening mechanisms, strengthening by grain size control, recovery and recrystallization. The fabrication of metals and metal alloys, fabrication of metals, forming operations, casting and other techniques will be covered. The fabrication of ceramics will include powder pressing and tape casting, since ceramics play a very important role in electronic packaging. The concepts of design of experiments and the Taguchi method will be covered with specific examples to soldering and annealing.

Topics to be Covered:

Semiconductor Crystal Growth (two weeks)

Electron grade silicon and compound semiconductors

Czochralski Crystal Growth

Silicon Shaping

Processing considerations

The mechanical properties of silicon and GaAs

Defects in silicon crystals and their control through solidification

Defects in GaAs crystals and their control through solidification

Other crystal growth techniques such as ribbon growth, sublimation and dendritic growth

(Macroprocessing) Technology (two weeks)

Package types for understanding macroprocessing

Thick Films in Packaging

Solders and solder processing. Flip chip interconnects as an application of soldering.

Tape automated bonding and wire bonding processes

Package Fabrication Technologies

Yield and Reliability, Design of Experiments

Intermetallic Compounds Processing

Processing of Metals (three weeks)

Mechanical Properties of Metals

Deformation mechanisms applied to deformation processing.